Apprenticeship and Industry Training

Water Well Driller

Apprenticeship Course Outline

3514 (2014)

Alberta

Apprenticeship and Industry Training

ALBERTA INNOVATION AND ADVANCED EDUCATION

Water well driller : apprenticeship course outline

ISBN 978-1-4601-1419-3 (PDF)

ALL RIGHTS RESERVED.

2014, Her Majesty the Queen in right of the Province of Alberta, as represented by the Minister of Advanced Education, 10th floor, Commerce Place, Edmonton, Alberta, Canada, T5J 4L5. All rights reserved. No part of this material may be reproduced in any form or by any means, without the prior written consent of the Minister of Advanced Education.

Water Well Driller
Table of Contents

Water Well Driller Table of Contents 1
Apprenticeship 2
Apprenticeship and Industry Training System 2
Apprenticeship Safety 4
Technical Training 5
Procedures for Recommending Revisions to the Course Outline 5
Apprenticeship Route toward Certification 6
Water Well Driller Training Profile 7

Course Outline

First Period Technical Training 10
Second Period - Water Well Driller Technical Training 16
Second Period - Earth Loop Technical Training 20

Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Water Well Driller Provincial Apprenticeship Committee.

The graduate of the Water Well Driller apprenticeship program is a certified journeyperson who will be able to:

- through skill and knowledge, is capable of operating the machines used to produce bore holes
- complete a bore hole into a finished productive well
- complete well records and reports as required by the industry
- complete well records and reports as required by Alberta Environment
- disinfect and service completed wells and pumping equipment
- familiar with the work in related trades such a mechanics and plumbers
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Water Well Driller PAC Members at the Time of Publication

Mr. C. Quinlan	DeWinton	Presiding Officer
Mr. J. Larson	Lougheed	Employer
Mr. G. Whitesell	Red Deer	Employer
Mr. D. Schmidt	Ponoka	Employer
Mr. S. Kinch	Cochrane	Employer
Mr. B. Sewell	High River	Employee
Mr. E. Miller	Strathmore	Employee
Mr. L. Odegard	Lougheed	Employee

Alberta Government

Alberta Advanced Education works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board (board) fully supports safe learning and working environments and emphasizes the importance of safety awareness and education throughout apprenticeship training- in both on-the- job training and technical training. The board also recognizes that safety awareness and education begins on the first day of on-the-job training and thereby is the initial and ongoing responsibility of the employer and the apprentice as required under workplace health and safety training. However the board encourages that safe workplace behaviour is modeled not only during on-the-job training but also during all aspects of technical training, in particular, shop or lab instruction. Therefore the board recognizes that safety awareness and training in apprenticeship technical training reinforces, but does not replace, employer safety training that is required under workplace health and safety legislation.

The board has established a policy with respect to safety awareness and training:

> **The board promotes and supports safe workplaces, which embody a culture of safety for all apprentices, employers and employees. Employer required safety training is the responsibility of the employer and the apprentice, as required under legislation other than the *Apprenticeship and Industry Training Act*.**

The board's complete document on its 'Apprenticeship Safety Training Policy' is available at www.tradesecrets.alberta.ca; access the website and conduct a search for 'safety training policy'.

Implementation of the policy includes three common safety learning outcomes and objectives for all trade course outlines. These common learning outcomes ensure that each course outline utilizes common language consistent with workplace health and safety terminology. Under the title of 'Standard Workplace Safety', this first section of each trade course outline enables the delivery of generic safety training; technical training providers will provide trade specific examples related to the content delivery of course outline safety training.

Occupational Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Occupational Health and Safety (a division of Alberta Human Services) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.albertahumanservices.ca

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Water Well Driller apprenticeship technical training:

Red Deer College

Procedures for Recommending Revisions to the Course Outline

Advanced Education has prepared this course outline in partnership with the Water Well Driller Provincial Apprenticeship Committee.

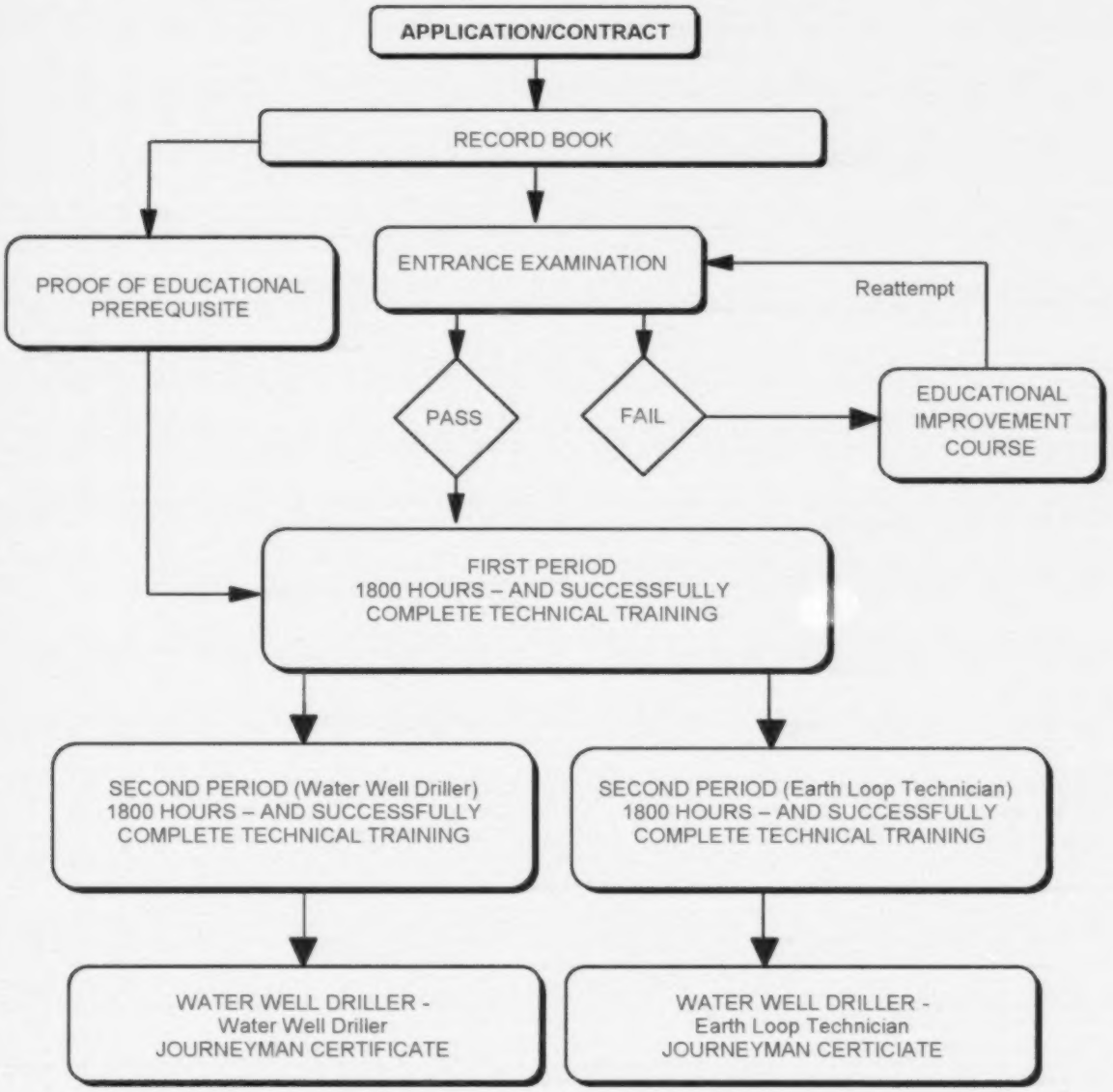
This course outline was approved on December 14, 2012 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Water Well Driller Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Water Well Driller Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification



Water Well Driller Training Profile
First Period
(6 Weeks 30 Hours per Week – Total of 180 Hours)

SECTION ONE

STANDARD WORKPLACE SAFETY AND REGULATIONS
41 HOURS

A	B	C
Safety Legislation, Regulations & Industry Policy in the Trades 4 Hours	Climbing, Lifting, Rigging and Hoisting 4 Hours	Hazardous Materials & Fire Protection 4 Hours
D	**E**	**F**
Alberta's Industry Network 2 Hours	Water Well and Geothermal Industry Roles and Associations 2 Hours	Trade Specific Regulations 5 Hours
G	**H**	**I**
Trade Specific Safety 8 Hours	Standards and Regulations 8 Hours	Business Practices 4 Hours

SECTION TWO

ENGINE AND SUPPORT SYSTEMS
31 HOURS

A	B	C
Powertrains 4 Hours	Cooling Systems 4 Hours	Lubrication Systems 4 Hours
D	**E**	**F**
Fuel Supply Systems 4 Hours	DC Electrical Systems and Equipment 5 Hours	Batteries 3 Hours
G	**H**	**I**
Brake Systems 2 Hours	Service Schedules 2 Hours	Hand and Power Tools 3 Hours

SECTION THREE

HYDRAULICS
18 HOURS

A
Hydraulic Systems 18 Hours

SECTION FOUR

WELDING
30 HOURS

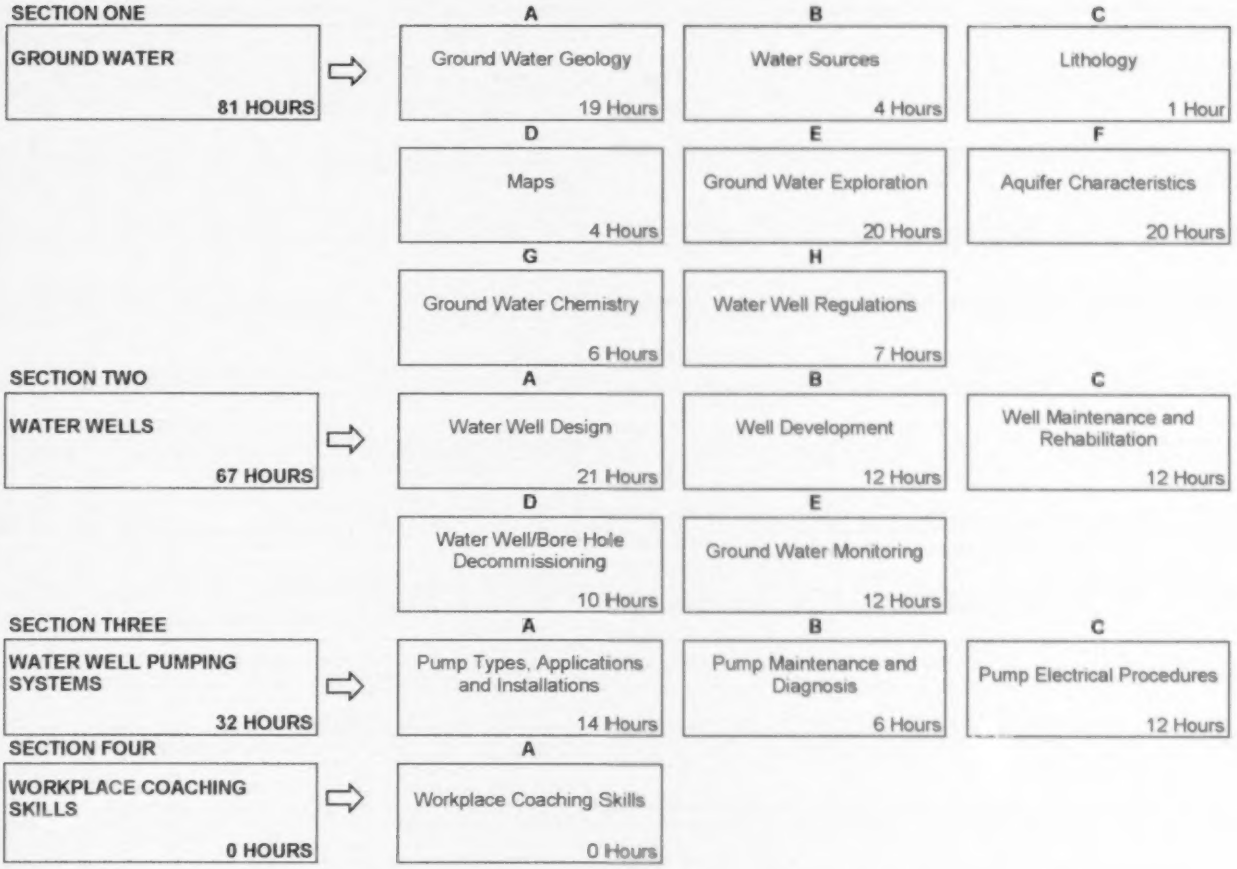
A	B
Metal Heating and Cutting 12 Hours	Arc Welding 18 Hours

SECTION FIVE

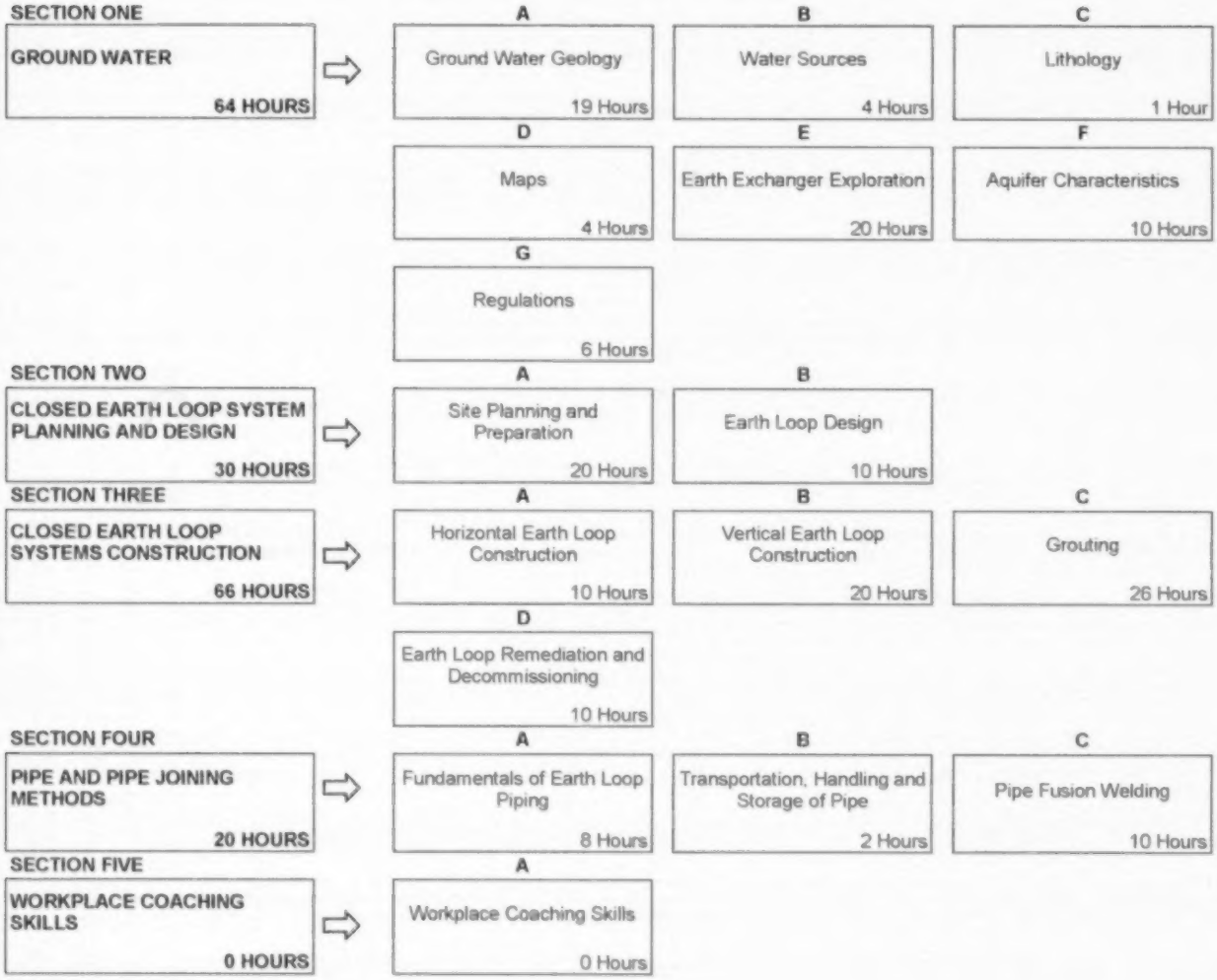
DRILLING SYSTEMS
60 HOURS

A	B	C
Compressed Air Systems 12 Hours	Drilling Safety 3 Hours	Drilling Fluids 8 Hours
D	**E**	**F**
Cable Tool Drilling 4 Hours	Rotary and Air Hammer Drilling 20 Hours	Auger and Boring Drilling 6 Hours
G		
Specialized Drilling Systems 7 Hours		

Second Period – Water Well Driller
(6 Weeks 30 Hours Per Week – Total of 180 Hours)



Second Period – Earth Loop Technician
(6 Weeks 30 Hours Per Week – Total of 180 Hours)



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
WATER WELL DRILLER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... STANDARD WORKPLACE SAFETY AND REGULATIONS ..... 41 HOURS

A. Safety Legislation, Regulations & Industry Policy in the Trades .....4 Hours

Outcome: ***Describe legislation, regulations and practices intended to ensure a safe work place in the trade.***

1. Apply the Occupational Health and Safety Act, Regulation and Code.
2. Explain the employer and employee responsibilities regarding Occupational Health and Safety (OH&S) regulations, Worksite Hazardous Materials Information System (WHMIS), fire regulations, Workers Compensation Board regulations, and related advisory bodies and agencies.
3. Explain industry practices for hazard assessment and control procedures.
4. Describe the responsibilities of workers and employers to apply emergency procedures.
5. Describe positive tradesperson attitudes with respect to housekeeping, personal protective equipment and emergency procedures.
6. Describe the roles and responsibilities of employers and employees with respect to the selection and use of personal protective equipment (PPE).
7. Select, use and maintain appropriate PPE for worksite applications.

B. Climbing, Lifting, Rigging and Hoisting .....4 Hours

Outcome: ***Describe the use of personal protective equipment (PPE) and safe practices for climbing, lifting, rigging and hoisting in the trade.***

1. Select, use and maintain specialized personal protective equipment (PPE) for climbing, lifting and load moving equipment.
2. Describe manual lifting procedures using correct body mechanics.
3. Describe rigging hardware and the safety factor associated with each item.
4. Select the correct equipment for rigging typical loads.
5. Describe hoisting and load moving procedures.

C. Hazardous Materials & Fire Protection.....8 Hours

Outcome: ***Describe the safety practices for hazardous materials and fire protection in the trade.***

1. Describe the roles, responsibilities, features and practices related to the Workplace Hazardous Materials Information System (WHMIS) program.
2. Describe the three key elements of WHMIS.
3. Describe handling, storing and transporting procedures when dealing with hazardous materials.
4. Describe safe venting procedures when working with hazardous materials.
5. Describe fire hazards, classes, procedures and equipment related to fire protection.

D. Alberta's Industry Network ..... 2 Hours

Outcome: ***Describe the role of the Alberta Apprenticeship and Industry Training Board and the network of industry committees that represent the trades and occupations in Alberta.***

1. Describe Alberta's apprenticeship and industry training system.
2. Describe the roles and responsibilities of the Alberta Apprenticeship and Industry training Board, government and post-secondary institutions.
3. Describe the roles and responsibilities of the industry network committees.

E. Water Well and Geothermal Industry Roles and Associations ..... 2 Hours

Outcome: ***Explain the role of water well and geothermal industry associations.***

1. Describe the scope of the Alberta water well and geothermal industries.
2. Describe technical training opportunities in the trade.
3. Describe trade specific industry associations.

F. Trade Specific Regulations ..... 5 Hours

Outcome: ***Apply regulations governing the work of the trade.***

1. Describe regulations pertaining to transporting dangerous goods.
2. Explain the Apprenticeship and Industry Training Act support regulations pertaining to the work of the trade.
3. Explain the relevant divisions of the Traffic Safety Act.

G. Trade Specific Safety ..... 8 Hours

Outcome: ***Apply safety procedures associated with work in the trade.***

1. Describe trade-specific work hazards.
2. State the safety considerations when dealing with natural gas encounters.
3. Use safety equipment and procedures associated with the trade.
4. Demonstrate care and control of hazardous products used in the trade.

H. Standards and Regulations ..... 8 Hours

Outcome: ***Apply regulations, standards and procedures governing the drilling and construction of water wells and geothermal earth loops.***

1. Identify regulations governing the drilling and construction of water wells and geothermal earth loops.
2. Describe processes for drafting and sending documentation to regulatory authorities.
3. Maintain records and reports.
4. Distribute records and reports to stakeholders.

I. Business Practices ..... 4 Hours

Outcome: ***Apply business, financial and customer service practices.***

1. Identify the elements of a business plan and contracts.
2. Maintain financial records.

3. Describe financial planning, project planning, estimating, bidding and scheduling.
4. Identify customer service practices.
5. Describe employer and employee relations.

SECTION TWO: .....ENGINE AND SUPPORT SYSTEMS..... 31 HOURS

A. Powertrains .....4 Hours

Outcome: Service vehicle powertrains.

1. Identify common types and configurations of engines and powertrains.
2. Describe the operating principles of two and four-stroke engines.
3. Describe service procedures for powertrain components.
4. Identify specialty control devices.

B. Cooling Systems.....4 Hours

Outcome: Maintain vehicle cooling systems.

1. Identify the operating principles of air and liquid cooling systems.
2. Identify the components of air and liquid cooling systems.
3. Describe the procedures for removal, recovery and replacement of coolant.
4. Describe the removal and replacement of cooling system components.
5. Describe routine cooling system servicing.
6. Maintain vehicle cooling systems.

C. Lubrication Systems.....4 Hours

Outcome: Maintain vehicle lubrication systems.

1. Describe types of oils and greases.
2. Describe oil filter system types, operating principles and installation and inspection procedures.
3. Identify lubrication system leaks.
4. Describe the purpose of oil coolers and heat exchangers.
5. Describe procedures for greasing rig and truck components.
6. Analyze engine oil for condition, presence of moisture and foreign substances.
7. Maintain vehicle lubrication systems.

D. Fuel Supply Systems.....4 Hours

Outcome: Service vehicle fuel supply systems.

1. Describe types and grades of fuel.
2. Identify precautions for working with different fuel types.
3. Identify fuel supply system components.
4. Describe fuel supply system operation.
5. Describe the procedures for removal and recovery of fuel.
6. Describe the removal and replacement of components of a fuel supply system.
7. Service vehicle fuel supply systems.

E. DC Electrical Systems and Equipment ..... 5 Hours

Outcome: Service electrical systems and equipment.

1. Explain electrical theories.
2. Identify electrical terms and symbols.
3. Identify electrical circuit types and their faults.
4. Identify a shorted, open or grounded electrical circuit.
5. Identify electrical systems serviced by drillers.
6. Describe troubleshooting procedures for electrical systems.
7. Describe hazards associated with electrostatic discharge (ESD).
8. Describe removal and replacement procedures for faulty electrical components.
9. Perform wire harness and connector repairs.
10. Service vehicle electrical systems.

F. Batteries ..... 3 Hours

Outcome: Perform servicing of batteries.

1. Describe the purpose, construction, operation and ratings of batteries.
2. Describe battery hazards and maintenance requirements.
3. Diagnose problems attributed to batteries.
4. Perform servicing of batteries.

G. Brake Systems ..... 2 Hours

Outcome: Operate air brake systems.

1. Explain the operating principles of hydraulic and air brake systems.
2. Identify the functions of hydraulic and air brake system components.
3. Describe a process for identifying damaged or worn brake system components.
4. Verify brake system operation.
5. Operate air brake systems.

H. Service Schedules ..... 2 Hours

Outcome: Implement an equipment maintenance schedule.

1. Interpret maintenance schedules according to hour meters and drilling conditions.
2. Identify engine running conditions that could alter maintenance schedules.
3. Implement an equipment maintenance schedule.

I. Hand and Power Tools ..... 3 Hours

Outcome: Use hand and power tools common to the trade.

1. Verify the serviceable condition of hand and power tools.
2. Identify specialty hand and power tools common to the trade.
3. Use measuring principles and tools.

4. Describe the capacities and limitations of hand and power tools.
5. Use trade specific hand and power tools.

SECTION THREE: .....HYDRAULICS..... 18 HOURS

A. Hydraulic Systems.....18 Hours

Outcome: Maintain hydraulic systems on a drilling rig.

1. Identify the types, layout and principles of operation of hydraulic systems applicable to drilling rigs.
2. Describe the functions and layout of hydraulic system components.
3. Diagnose hydraulic system failures.
4. Perform hydraulic system maintenance according to manufacturer's specifications or prescribed service schedules.

SECTION FOUR: .....WELDING..... 30 HOURS

A. Metal Heating and Cutting.....12 Hours

Outcome: Use oxy-fuel heating and cutting equipment.

1. Describe the characteristics, composition and handling of oxy-fuel gases.
2. Assemble oxy-fuel heating and cutting equipment.
3. Use oxy-fuel heating and cutting equipment.

B. Arc Welding.....18 Hours

Outcome: Produce tack welds using arc welding equipment.

1. Describe personal protective equipment used for arc welding.
2. Describe the type and use of arc welding power sources.
3. Describe the operation and use of accessories required in arc welding.
4. Describe the types and uses of electrodes.
5. Assemble, adjust and operate arc welding equipment.
6. Perform lap, butt and plug tack welds on steel using various material thicknesses and joint configurations.
7. Demonstrate tack welding in flat, vertical and horizontal positions.
8. Identify weld faults.
9. Maintain arc welding equipment.

SECTION FIVE: .....DRILLING SYSTEMS..... 60 HOURS

A. Compressed Air Systems .....12 Hours

Outcome: Operate compressed air drilling systems.

1. Identify types of compressors.
2. Describe the operational safety requirements of compressed air drilling systems.

3. Maintain compressed air drilling systems.
4. Operate compressed air drilling systems.

B. Drilling Safety ..... 3 Hours

Outcome: Work safely on a drilling site.

1. Identify safety hazards on the worksite.
2. Demonstrate safety procedures and regulations on the worksite.

C. Drilling Fluids ..... 8 Hours

Outcome: Select appropriate drilling fluids when drilling.

1. Describe types and uses of drilling fluids.
2. Describe the difference between drilling fluids and grouts.
3. Select an appropriate drilling fluid for the drilling conditions.
4. Select appropriate grout for the application.

D. Cable Tool Drilling ..... 4 Hours

Outcome: Use cable tool drilling systems.

1. Use terminology associated with cable tool drilling systems.
2. Explain the operating principles of cable tool drilling.

E. Rotary and Air Hammer Drilling ..... 20 Hours

Outcome: Use rotary and air hammer drilling equipment.

1. Describe the terminology and equipment used for rotary and air hammer drilling.
2. Explain the principles of operation of rotary and air hammer drilling systems.
3. Describe procedures for aligning and plumbing a drilling rig.
4. Describe the types and uses of drilling bits.
5. Select the appropriate bit for a particular application.
6. Use rotary and air hammer drilling equipment.

F. Auger and Boring Drilling ..... 6 Hours

Outcome: Use auger and boring drilling equipment.

1. Describe the terminology and equipment associated with auger and boring drilling.
2. Explain the principles of operation of these types of drilling systems.
3. Use auger and boring drilling equipment.

G. Specialized Drilling Systems ..... 7 Hours

Outcome: Use specialized drilling equipment.

1. Describe the terminology and equipment associated with specialized drilling equipment.
2. Describe new specialized drilling technologies.

SECOND PERIOD TECHNICAL TRAINING
WATER WELL DRILLER TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... GROUND WATER ..... 81 HOURS

A. Ground Water Geology ..... 19 Hours

Outcome: Identify the geology and hydrogeology encountered when drilling.

1. Identify rock types and the natural processes that form them.
2. Describe Alberta's geologic column.
3. Describe the Hydrologic Cycle.
4. Identify properties of formations affecting water storage and movement.

B. Water Sources ..... 4 Hours

Outcome: Identify different sources of water using proper terminology.

1. Define surface water.
2. Describe the effects of surface water on the water table.
3. Define ground water.

C. Lithology ..... 1 Hour

Outcome: Produce a lithology report.

1. Describe the sequence and format used in lithology reporting.
2. Use appropriate abbreviations in a lithology report.

D. Maps ..... 4 Hours

Outcome: Interpret maps used in the industry.

1. Interpret maps that pertain to geology, hydrogeology and location.

E. Ground Water Exploration ..... 20 Hours

Outcome: Select appropriate drilling sites.

1. Describe the site selection process.
2. Describe the process of taking samples and logging them.

F. Aquifer Characteristics ..... 20 Hours

Outcome: Determine aquifer potential.

1. Describe ground water flow as it pertains to various formations.
2. Identify hydraulic properties of rocks.
3. Perform aquifer tests.
4. Record the readings of aquifer tests.

5. Interpret aquifer test results.
6. Describe new technologies for data collection.

G. Ground Water Chemistry ..... 6 Hours

Outcome: Determine ground water chemistry characteristics.

1. Perform ground water chemistry tests.
2. Interpret ground water chemistry reports.
3. Describe techniques for water sample collection.

H. Water Well Regulations ..... 6 Hours

Outcome: Apply government legislation, regulations and guidelines relating to work in the trade.

1. Describe government legislation, regulations and guidelines relating to work in the trade.

SECTION TWO: ..... WATER WELLS ..... 67 HOURS

A. Water Well Design ..... 21 Hours

Outcome: Design a water well.

1. Describe the history of well design.
2. Identify the types of wells.
3. Describe the types of formations.
4. List considerations for well design.
5. Describe the types and sizing of casing.
6. Describe the methods of sealing, grouting and cementing casings.
7. Describe the methods of setting and sealing screens.
8. Identify the types of screens, filter packs and pressure tanks.
9. Describe the methods of installing filter packs.
10. Design a water well.

B. Well Development ..... 12 Hours

Outcome: Use development techniques to maximize well efficiency.

1. Describe the theory of well development.
2. Describe the techniques of well development.
3. Describe the methods of well and piping disinfection.
4. Determine well efficiency.

C. Well System Maintenance and Rehabilitation ..... 12 Hours

Outcome: Perform well system maintenance and rehabilitation procedures.

1. Describe the causes of well system and equipment failures.
2. Identify the methods of well system inspection, maintenance, rehabilitation and repair.
3. Identify pollution problems and methods of correction.

D. Water Well and Bore Hole Decommissioning ..... 10 Hours

Outcome: Decommission water wells and bore holes.

1. Identify the equipment required for decommissioning a water well or bore hole.
2. Describe the regulations and methods to decommission a water well or bore hole.

E. Ground Water Monitoring ..... 12 Hours

Outcome: Drill ground water monitoring wells.

1. Identify ground water contamination sources.
2. Describe containment movement.
3. Describe how to locate monitoring wells.
4. Describe monitor well construction and design.

SECTION THREE: ..... WATER WELL PUMPING SYSTEMS ..... 32 HOURS

A. Pump Types, Applications and Installation ..... 14 Hours

Outcome: Install a water pumping system at a well site.

1. Identify types of shallow and deep well pumps.
2. Select pump type according to application and sizing.
3. Describe installation procedures for the different pump types.
4. Describe licensing and equipment requirements.
5. Describe procedures for encountering natural gas.

B. Pump Maintenance and Diagnosis ..... 6 Hours

Outcome: Perform diagnostic and maintenance procedures on pumping systems.

1. Demonstrate pumping system tests.
2. Troubleshoot pumping systems.
3. Demonstrate pump maintenance and repair procedures.

C. Pump Electrical Procedures ..... 12 Hours

Outcome: Install motor controls on water well pumping system.

1. Describe electrical code requirements.
2. Identify electrical circuit types.
3. Describe lockout and tag out procedures.
4. Use a voltmeter, amp probe and ohmmeter.
5. Describe the methods used to wire motor controls.
6. Describe procedures for protecting and burying underground cables.
7. Install a waterproof splice on a submersible pump lead.
8. Perform electrical cable connecting and disconnecting at the well head for service.
9. Install a control box.

10. Install a motor ground on a pumping system.
11. Demonstrate electrical tests as required on pumping systems.

SECTION FOUR: ..... WORKPLACE COACHING SKILLS ..... 0 HOURS

A. Workplace Coaching Skills ..... 0 Hours

Outcome: Display coaching skills

1. Describe coaching skills used for training apprentices.

SECOND PERIOD TECHNICAL TRAINING
EARTH LOOP TECHNICIAN TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: ..... GROUND WATER ..... 64 HOURS

A. Ground Water Geology ..... 19 Hours

Outcome: Identify the geology and hydrogeology encountered when drilling.

1. Identify rock types and the natural processes that form them.
2. Identify the thermal conductivity of rock types.
3. Describe Alberta's geologic column.
4. Identify properties of formations affecting water storage and movement.
5. Identify water zones.

B. Water Sources ..... 4 Hours

Outcome: Identify different sources of water using appropriate terminology.

1. Define surface water.
2. Describe the effects of surface water on the water table.
3. Define ground water.

C. Lithology ..... 1 Hour

Outcome: Produce a lithology report.

1. Describe the sequence and format used in lithology reporting.
2. Use appropriate abbreviations in a lithology report.

D. Maps ..... 4 Hours

Outcome: Interpret maps used in the drilling industry.

1. Interpret maps that pertain to geology, hydrogeology and location.
2. Demonstrate how to access and interpret the ground water information system provided through Alberta Environment.

E. Earth Exchanger Exploration ..... 20 Hours

Outcome: Select appropriate drilling sites.

1. Describe the site selection process.
2. Determine the location of aquifers when drilling.
3. Calculate thermal conductivity.

F. Aquifer Characteristics ..... 10 Hours

Outcome: Describe hydraulic properties of rocks in various formations.

1. Describe ground water flow as it pertains to various formations.
2. Identify the hydraulic properties of rocks.

G. Regulations ..... 6 Hours

Outcome: Apply government legislation, regulations and guidelines relating to work in the trade.

1. Describe government legislation, regulations and guidelines relating to work in the trade.

SECTION TWO: ..... CLOSED EARTH LOOP SYSTEMS PLANNING AND DESIGN ..... 30 HOURS

A. Site Planning and Preparation ..... 20 Hours

Outcome: Implement a closed earth loop system.

1. Obtain ground disturbance certification.
2. Create a closed earth loop system site plan.
3. Describe methods of locating utilities and private underground services.
4. Determine site access, material storage and handling and water supply.
5. Describe methods for containing and disposing of cuttings.
6. Describe methods of clearing sites and disposing of overburden.
7. Identify site hazards and safe working distances from utilities.

B. Earth Loop Design ..... 10 Hours

Outcome: Design a closed earth loop system.

1. Calculate residential design load, energy load and ground load.
2. Calculate the earth loop configuration for a given ground load.
3. Describe differences between residential and commercial loads.
4. Use thermal conductivity values.

SECTION THREE: ..... CLOSED EARTH LOOP SYSTEMS CONSTRUCTION ..... 66 HOURS

A. Horizontal Earth Loop Construction ..... 10 Hours

Outcome: Construct horizontal earth loop systems.

1. Describe safety considerations when trenching.
2. Identify trenching methods and procedures.
3. Identify problematic encounters during the drilling and construction of horizontal earth loop systems.
4. Identify equipment types and methods used in the construction of horizontal earth loop systems.
5. Describe requirements and procedures for site restoration.

B. Vertical Earth Loop Construction ..... 20 Hours

Outcome: Construct vertical earth loop systems.

1. Identify safety considerations for vertical earth loop construction.
2. Identify equipment types and methods used in the construction of vertical earth loop systems.
3. Identify problems during the drilling and construction of vertical earth loop systems.
4. Describe procedures for flushing, purging and pressure testing.
5. Describe the types of heat transfer fluids, viscosities and charging procedures.

C. Grouting ..... 26 Hours

Outcome: Grout earth loop systems.

1. Describe the purpose of grouting.
2. Describe the properties of grouts and mixes.
3. Calculate volumes for grout mixes.
4. Identify the current industry grouting practices and procedures.
5. Identify equipment types and methods used in the grouting of earth loop systems.
6. Describe remediation procedures for grout loss.

D. Earth Loop Remediation and Decommissioning ..... 10 Hours

Outcome: Apply remediation and decommissioning procedures for earth loop systems.

1. Describe remediation and decommissioning procedures for earth loop systems.
2. Describe the reporting requirements for heat transfer fluid leakage and loop decommissioning.
3. Describe procedures for flushing, grouting and extracting decommissioned loops.
4. Describe procedures for collecting and disposing of heat transfer fluids.

SECTION FOUR: ..... PIPE AND PIPE JOINING METHODS ..... 20 HOURS

A. Fundamentals of Earth Loop Piping ..... 8 Hours

Outcome: Identify chemical and physical properties of earth loop pipe used in the trade.

1. Describe resins, polymers, and methods used in the manufacturing of earth loop pipe.
2. Identify standards governing the manufacturing and rating of earth loop pipe.
3. Calculate pressures at various depths of bore hole relative to ratings of earth loop pipe.

B. Transportation, Handling and Storage of Pipe ..... 2 Hours

Outcome: Use appropriate procedures in the transportation, handling and storage of pipe.

1. Calculate the volume and area required to transport and store earth loop pipe.
2. Describe methods for storing earth loop pipe.
3. Describe methods for temporary capping of earth loop pipes.

C. Pipe Fusion Welding ..... 10 Hours

Outcome: Perform fusion welding on pipe and fittings.

1. Describe regulations governing the fusion welding of earth loop pipe.
2. Describe equipment types and methods used in fusion welding.
3. Prepare pipe for fusion welding.
4. Demonstrate procedures for care, cleaning, and storage of fusion welding equipment.

SECTION FOUR: ..... WORKPLACE COACHING SKILLS ..... 0 HOURS

A. Workplace Coaching Skills ..... 0 Hours

Outcome: Display coaching skills

1. Describe coaching skills used for training apprentices.

Excellence through training and experience

3514